

Claims

1. A device for measuring the rotational balance of an article, comprising
- 5 - a spindle unit (7) with a spindle holder (29) and with a spindle (11) mounted on the spindle holder (29) rotatably about an axis of rotation (9) and carrying at one of its two ends a coupling (13) for fastening the article (17),
 - 10 - a holder suspension (49) for fastening the spindle unit (7) to a machine base (1), said holder suspension guiding the spindle holder (29) deflectably in a predetermined measurement direction for unbalance forces,
 - 15 - an electric motor (5) driving the spindle (11) in rotation, and
 - a sensor arrangement (61) measuring the unbalance force in the predetermined measurement direction during rotation of the spindle (11),
- 20 characterized in that
- the spindle unit (7) and the electric motor (5) are combined into a first preassembled subassembly and the holder suspension (49) and the sensor arrangement (61) are combined into a second preassembled subassembly,
- 25 and in that the two subassemblies carry connecting elements (77), assigned to one another in an indexed manner, for the operationally releasable fastening of the subassemblies to one another, such connecting elements.
- 30
2. The device as claimed in claim 1, characterized in that the electric motor (5) is arranged axially parallel next to the spindle (11) so as to be offset with respect to the axis of rotation (9) of the spindle
- 35 (11) and is fastened to the spindle holder (29).
3. The device as claimed in claim 2, characterized in that the electric motor (5) is arranged in such a way that a plane containing the axes of rotation of the

electric motor (5) and of the spindle (11) is inclined with respect to an axial longitudinal plane of the spindle (11) perpendicular to the predetermined measurement direction.

5

4. The device as claimed in one of claims 1 to 3, characterized in that the electric motor (5) and the spindle holder (29) are flanged to a common connecting yoke (35) on the same side of the latter.

10

5. The device as claimed in claim 4, characterized in that that end of the spindle (11) which is remote from the fastening coupling (13) is drive-connected to the electric motor (5) by means of an endless drive belt (47).

15

6. The device as claimed in one of claims 1 to 5, characterized in that the fastening coupling (13) of the spindle unit (1) has a pneumatic actuating device, the compressed-air supply of which comprises a rotary compressed-air coupling which is held on the spindle holder (29) and which is in constant rotational engagement with the spindle (5).

20

7. The device as claimed in claim 6, characterized in that the rotary compressed-air coupling (109) is provided centrically to the axis of rotation (9) of the spindle (11) on a carrying arm (111) which is arranged solely within the region surrounded by the drive belt (47).

25

30

8. The device as claimed in one of claims 1 to 7, characterized in that the holder suspension (49) comprises two holder elements (51, 53) which are connected to one another deflectably in the predetermined measurement direction and of which one can be connected to the spindle holder (29) and the other to the machine base (1), and in that the sensor arrangement (61) has at least one force sensor held

35

between the two holder elements (51, 53).

9. The device as claimed in claim 8, characterized in that the holder elements (51, 53) are arranged at a distance from one another and are held against one another by at least one spacer (55) rigid in the distance direction and flexible transversely thereto at least in the measurement direction, in particular a plurality of such spacers (55).

10

10. The device as claimed in claim 9, characterized in that the spacers (55) are designed as leaf springs, the leaf spring plane of which runs perpendicularly to the measurement direction.

15

11. The device as claimed in claim 9 or 10, characterized in that the holder elements (51, 53) have projections (57, 59) which project in pairs toward one another and between which the force sensor is arranged.

20

12. The device as claimed in claim 8, characterized in that the holder elements (51b, 53b) are arranged at a distance from one another and are held against one another by at least one spacer (115) flexible in the distance direction defining the measurement direction and essentially rigid transversely thereto.

13. The device as claimed in claim 12, characterized in that the spacer (115) is designed as a U-shaped leg spring.

30

14. The device as claimed in one of claims 8 to 13, characterized in that the sensor arrangement (61) has two force sensors which are arranged at a distance from one another in the direction of the axis of rotation (9) of the spindle (11) and are held between the two holder elements (51, 53) and which are supported mirror-symmetrically on the two holder elements (51, 53) with respect to an axial longitudinal plane of the

35

spindle (11) perpendicular to the force measurement direction.

15. The device as claimed in one of claims 8 to 14,
5 characterized in that each force sensor (61) is assigned a spring element (67) prestressing the force sensor (61) in the predetermined force measurement direction.

10 16. The device as claimed in claim 15, characterized in that the force sensor (61) and the spring element (67) assigned to it are supported, prestressed, in series with one another on one of the two holder elements (51, 53), and the other holder element (51) is
15 supported on the force sensor (61) in the force path between the force sensor (61) and the spring element (67).

17. The device as claimed in claim 15 or 16,
20 characterized in that the force sensor (61) and/or the spring element (67) is held in the force measurement direction on both sides between pivot bearings, particularly balls or tips.

25 18. The device as claimed in one of claims 1 to 17, characterized in that the connecting elements (77) of the two subassemblies have joining faces (79, 81) which are intended to bear against one another and which allow predetermined positioning in the predetermined
30 measurement direction and in at least one direction perpendicular thereto.

19. The device as claimed in claim 18, characterized in that the connecting elements are designed as a
35 dovetail guide (77) and comprise clamping means (83) for fixing.

20. The device as claimed in claim 19, characterized in that the displacement direction of the dovetail

guide (77) runs in the direction of the axis of rotation (9) of the spindle (11).

21. The device as claimed in claim 19 or 20,
5 characterized in that the dovetail guide (77) has dovetail guide faces (79, 81), one (81) of which is integrally formed directly on the spindle holder (29).

22. The device as claimed in claim 21, characterized
10 in that the spindle holder (29) has essentially a cylindrical outer contour which surrounds the integrally formed dovetail guide face (81) on the outside.

23. The device as claimed in one of claims 19 to 22,
15 characterized in that the dovetail guide (77) is assigned an indexing limit stop (89) in the displacement direction.

24. The device as claimed in one of claims 19 to 23,
20 characterized in that the dovetail guide (77) has mutually assigned dovetail guide faces (79, 81) with bayonet cutouts (85, 87) which allow plugging together transversely to the displacement direction of the
25 dovetail guide (77).

25. The device as claimed in one of claims 18 to 24,
characterized in that the connecting elements (77) are
provided on the spindle holder (29) and the holder
30 suspension (49).

26. The device as claimed in one of claims 1 to 25 or
the preamble of claim 1, characterized in that there is
fastened at one of the axial ends of the spindle (11),
35 in particular at the end carrying the fastening coupling (13) for the article (17), an annular surface element (93), the circumference of which is provided with a magnetic or optical information carrier (95; 113) both for information representing the angle of

rotation and for information representing the zero-point rotary position, and in that a reading head arrangement (97; 97a) for reading this information is connected to the spindle holder (29).

5

27. The device as claimed in claim 26, characterized in that the information carrier (95; 113) has next to one another two information tracks (99) which are sensed separately from one another by the reading head
10 arrangement (97; 97a).

28. The device as claimed in claim 26 or 27, characterized in that the information carrier is designed as a magnetic tape portion (95) which is glued
15 onto the circumference of the annular surface element (93) and the mutually abutting ends of which are cut obliquely in the tape plane.

29. The device as claimed in claim 28, characterized in that the information representing the angle of rotation and/or the zero-point rotary position also overlaps the region of the oblique-cut joint (101) of the magnetic tape portion (95).

25 30. The device as claimed in claim 26 or 27, characterized in that the information carrier is designed as an optical information carrier, particularly in the form of an annular disk (113), which can be sensed by transmitted light.

30

31. The device as claimed in one of claims 26 to 30, characterized in that the annular surface element (93) has, on its surface facing away from the spindle (11), optical angular degree markings (103).